The Influence of Sea Surface Temperature on Tropical Cloud Solar Forcing

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The influence of tropical ocean anomalies on cloud forcing during El Nino Southern Oscillation through changes in sea surface temperature (SST) is examined with data from the International Satellite Cloud climatology Project (ISCCP), the Advanced Very High Resolution Radiometer (AVHRR) and the numerical weather prediction model of the European Center for Medium Range Weather Forecast (ECMWF).

Our results show that the change of total Chid forcing is dominated by high clouds in the west and central tropical oceans, and strongly influenced by low clouds in the east tropical oceans. High and low clouds response to SST anomaly in very different way, The change of high clouds occurs on global tropical scale during 1987 El Nino. Outside of the equatorial central and east Pacific, the decrease of high cloud is better correlated with SS1' warming inside the central and east Pacific than with local SST anomaly. Inside of the equatorial central and east Pacific, the increase of high cloud is in phase with suface wind convergence but not local SS1' warming although it correlates with both. These suggest that the response of high cloud to interannual variation of SST is controlled by the change of large-scale circulation. Low clouds in the east tropical oceans decreases as local SST increases in general. The response of low cloud to SST change appear to be local. Change of the inversion layer with SST may be the cause. Thus the influence of SST on total cloud forcing is controlled by multi-processes via different type of clouds.

Further spaceborne sensors planned for the Earth Observing System such as CERES, MODIS, and AIRS will enhance similar studies and contribute further in our understanding the roles of cloud in the energy balance of coupled ocean atmosphere system and the feedback to greenhouse warming.